

1 CLAIMS

2 1. A seal assembly for sealing an annular space
3 between an inner and an outer pipe in a double-
4 walled subsea pipeline which seal assembly:

5 (a) under normal operating conditions is in a
6 non-sealing position which allows the
7 passage of a gas through said seal
8 assembly; and

9 (b) is actuatable from a non-sealing position
10 to a sealing position in response to the
11 entry of liquid into said annular space.

12
13 2. A seal assembly according to claim 1 which

14 (a) in its non-sealing position provides an
15 opening in the annular space to allow the
16 passage of a gas through the seal
17 assembly; and

18 (b) comprises an annular member and moveable
19 blocking means such that entry of liquid
20 into said annular space causes movement of
21 said blocking means to close said opening.

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23 3. A seal assembly according to claim 2 wherein
24 the blocking means is moveable under pressure
25 of liquid flow.

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27 4. A seal assembly according to claim 2 which
28 comprises a liquid-sensitive material and
29 wherein the blocking means is moveable as a
30 result of interaction of the liquid with said
31 liquid-sensitive material.

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1 5. A seal assembly according to claim 3 wherein
2 (a) the annular member comprises one or more
3 orifices; and
4 (b) the moveable blocking means comprises a
5 diaphragm and a closure member such that
6 flow of liquid in said annular space
7 causes movement of the diaphragm which
8 causes movement of the closure member to
9 close said one or more orifices.

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11 6 A seal assembly according to claim 5 wherein
12 the diaphragm and closure member are both
13 annular in shape.

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15 7 A seal assembly according to any one of claims
16 2 to 4 wherein:
17 (a) the annular member comprises one or more
18 valves; and
19 (b) said valves each comprising one or more
20 orifices and moveable blocking means such
21 that flow of liquid in said annular space
22 causes movement of the moveable blocking
23 means to close said one or more orifices.

24
25 8 A seal assembly according to claim 7 wherein a
26 valve comprises a blocking plate with an
27 orifice and the moveable blocking means
28 comprises a diaphragm and a closure member
29 which closure member has apertures such that
30 flow of liquid in the annular space causes
31 movement of the diaphragm which causes movement
32 of the closure member against the blocking

1 plate closing the orifice in the blocking plate
2 and the apertures in the closure member.
3

4 9 A seal assembly according to claim 7 wherein
5 the moveable blocking means comprises biased
6 means attached to a closure member which biased
7 means is held in a biased position by means of
8 a liquid-sensitive material such that flow of
9 liquid in said annular space causes interaction
10 of said liquid with said liquid-sensitive
11 material causing said liquid-sensitive material
12 to release the biased means so that said biased
13 means effects movement of the closure member to
14 close said one or more orifices.
15

16 10 A seal assembly according to claim 9 wherein
17 the biased means is a spring.
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19 11 A seal assembly according to claim 9 or 10
20 wherein the liquid-sensitive material is a
21 water-soluble salt.
22

23 12 A seal assembly according to any one of claims
24 7 to 12 wherein the annular member comprises
25 one or more tubes in which tubes the one or
26 more valves are situated.
27

28 13 A seal assembly according to any one of the
29 preceding claims wherein the annular member is
30 dimensioned so that it will extend from the
31 inner wall of the outer pipe to the outer wall
32 of the inner pipe and will be in sealing

1 contact with each of said inner and said outer
2 walls.

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4 14 A seal assembly according to any one of claims
5 1 to 3 wherein

6 (a) the annular member is dimensioned so that
7 it will be sealing contact with only one
8 of the inner wall of the outer pipe and
9 the outer wall of the inner pipe and will
10 provide an opening in said annular space
11 between the annular member and the wall
12 with which it is not in sealing contact;
13 and

14 (b) the moveable blocking means comprises
15 resilient means which is deformable under
16 the pressure of liquid flow in the annular
17 space to close said opening.

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19 15 A seal assembly according to claim 14 wherein
20 the annular member has a longitudinal end face
21 which has a recess to define upper and lower
22 arms and one of these arms is the resilient
23 means deformable under the pressure of liquid
24 flow in the annular space to close said
25 opening.

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27 16 A seal assembly according to claim 13 or claim
28 14 which comprises annular restraining means
29 bonded to the upper and lower arms of the
30 annular member.

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- 1 17 A pipe system comprising an inner and an outer
2 pipe and a seal assembly according to any one
3 of the preceding claims.
4
5 18 A valve suitable for use in the seal assembly
6 of any one of claims 7 to 12.
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